jbr
environmental consultants, inc.
8160 South Highland Drive • Sandy, Utah 84093 • (801) 943-4144 • Fax (801) 942-1852

m/023/007

RECEIVED
OCT 04 2000
DIVISION OF
OIL, GAS AND MINING

October 2, 2000

Mr. Don Ostler, P.E.
Director
Utah Division of Water Quality
288 North 1460 West
P.O. Box 144870
Salt Lake City, Utah 84114-4870

Ms. Pam Grubaugh-Littig
Utah Division of Oil, Gas and Mining
1594 West North Temple, Suite 1210
P.O. Box 145801
Salt Lake City, Utah 84414-5801

Subject: Preliminary Draft Post Closure Fluid Management Plan - North Lily Silver City Facility

Dear Mr. Ostler and Ms. Littig:

A preliminary draft Post Closure Fluid Management Plan for North Lily's Silver City facility is attached. In the interest of time and economy, the plan has been submitted without a contaminant fate and transport assessment (for reasons explained in the plan) and sketch-level designs only have been provided. The plan demonstrates that infiltration is a viable but, as currently designed, expensive option, due to the large area required for infiltration. The comments and advice of both division staffs, but especially those of the Division of Air Quality are sought before proceeding farther with design and related expenditures.

0049

Thank you for your cooperation in this matter. Please contact the undersigned with any questions you may have.

Sincerely,

MJC Robert J. Bayer

Robert J. Bayer
Vice President

cc: Dennis Frederick, DWQ (w/attachment)
Fred Pehrson, DWQ
Beth Wondimu, DWQ
Mary Ann Wright, Division of Oil Gas and Mining
[redacted] Division of Oil Gas and Mining (w/attachment)
Stephen Flechner, North Lily Mining Company (w/attachment)
Mike Keller, VanCott Bagley

NORTH LILY MINING COMPANY
SILVER CITY HEAP LEACH FACILITY
POST-CLOSURE FLUID MANAGEMENT PLAN

This plan for management of post-closure fluids draining from the heap leach ("heap") at the Silver City Heap Leach Facility ("Facility") has been prepared by JBR Environmental Consultants, Inc. (JBR) at the request of North Lily Mining Company (North Lily)

Plan Objective. To prepare plan for management of leach pad drain-down fluids beginning in the fourth quarter 2000 and continuing until pad draindown has ceased. The system is envisioned to be operated initially with three components: solution storage, using the existing pregnant solution pond and the overflow pond, as necessary; enhanced evaporation using the pregnant solution pond and, if necessary the overflow pond, when weather and temperatures are favorable; and a leachfield for fluid disposal by infiltration. When the pad draindown rate becomes stable and the evaporation system is no longer needed, the leachfield would be used to dispose of all draindown water. Until that as-yet-undetermined time, sufficient evaporation and/or storage capacity to accommodate anticipated draindown fluids without re-application to the heap would be maintained in either the pregnant or overflow pond, or both, as needed.

Background. The Conceptual Post Closure Fluid Management Plan (August, 2000 by JBR) discussed two approaches to fluid disposal: land application and infiltration. The Division of Water Quality (DWQ) rejected land application as an approvable alternative and conditionally accepted infiltration as the preferred means of disposal. The approved reclamation plan for the Facility calls for treatment of draindown fluids with an anoxic bioreactor; however, for reasons discussed in the Conceptual Plan, this alternative is not considered viable for this application. Please refer to the Conceptual Plan for further background information.

Design Considerations. Preliminary design considerations were listed in the Conceptual Plan. Since preparation of the conceptual plan, percolation tests on the site have been completed and a water quality sample from the preg. pond inflow has been collected and analyzed.

Percolation Test Results. Two percolation tests were conducted on the site: one to the west of the mill building and one to the south of the heap. The tests were conducted in accordance with testing procedures in UAC R317-4-5. The results of the tests are:

West Test Pit 1.85×10^{-3} cm/sec
South Test Pit 8.82×10^{-4} cm/sec.

The west test pit encountered slightly sandy and clayey, calcareous silt. The south test pit was excavated in calcareous silty clay.

Water Quality. Water quality data for three samples from the preg. pond inflow, two collected by DWQ, in 1999 and 2000, and one collected by JBR in August 2000. The results of these analyses are shown in Table A-1 (Appendix). Pad draindown water quality was fairly consistent among most of the parameters analyzed over the approximately one-year sampling period. Notable is the consistency among the concentrations of several of the indicator parameters and major ions: TDS, chloride, sodium. Also notable is the variability among nitrate+nitrite, sulfate and copper. The very high concentration of nitrate+nitrite in the April 2000 sample compared with the other two samples suggests that this analysis may be in error. Of the analytes shown in Table 1A, Utah Ground Water quality Standards have been established for 14 of them. Of those 14, the standards were exceeded in one or more of the samples for 11 parameters: cyanide, fluoride, nitrite, nitrate+nitrite, copper, arsenic, cadmium, mercury, lead, selenium, and silver.

Fate and Transport. Based upon JBR's experience in closure and ground water impact assessment projects in Utah and elsewhere, we believe that the proposed system concept can be successful in disposing of draindown fluid in a manner that results in non-degradation of ground water. The draindown water quality is such that significant natural attenuation, perhaps aided by some pretreatment for cyanide, will be necessary in order for this to occur. A fate and transport assessment for the contaminants in the fluid proposed for disposal in the leachfield is necessary to evaluate ground water impact. This evaluation has been initiated by JBR; however, it is not yet complete. In consideration of North Lily's budget constraints, JBR proposes to obtain DWQ feedback on the proposed leachfield design and discuss with appropriate DWQ staff the approach for conducting the fate and transport evaluation prior to completing this evaluation.

System Sizing. The two primary factors to be considered in system selection and sizing are the volume and flow rate of water to be handled and the water handling capacity of the system.

Leach Pad Draindown Rate. The post-closure pad draindown rate cannot yet be estimated. It is possible that this rate will not be determinable until the vegetative cover for the heap is established; however, a range of from 10 to 20 gpm has been assumed for design purposes at this time. For reference, the current draindown rate is approximately 10 gpm.

Leachfield Infiltration Capacity. The leachfield infiltration capacity should ideally be able to equal or exceed the pad draindown rate. Factors affecting leachfield capacity are size and soil permeability. A single percolation test has been conducted in the area. Further tests may be necessary to obtain a level of comfort with the consistency of

permeability in the area. The available area for leachfield installation in the area of the more permeable soil west of the mill building is relatively small, perhaps four to five acres (assuming that the solution pond areas are not available as leach field construction sites).

System Design. The system design is considered a draft. The design requirements set forth in UAC R317-4-9 have been followed in preparing the proposed design. Significant design uncertainties remain at this point: the required system capacity; the uniformity of permeability in the proposed location for the leachfield; and, the cost of leachfield construction. Given the unique budget limitations, North Lily, DOGM, and DWQ must be completely confident in the system concept and design before it is constructed. Terrain, soil conditions, (hard and potentially expensive to excavate), space limitations, and the extensive area required for infiltration of the estimated 5 to 10 gpm of draindown water are likely to result in relatively high cost of leachfield construction.

Design Overview. The flow sheet for the proposed fluid disposal system is shown in Appendix B. The upper flow sheet shows the current fluid flow and lower shows the fluid flow in the proposed system. The latter flow sheet is labeled "interim system." This is because the proposed leachfield and related components have been designed to operate concurrently with the enhanced evaporation system or with the preg. and overflow ponds in use for fluid storage. Since the preg. pond will be in place when leachfield operation begins, an in-pond sump, to be located in the northwest corner of the preg. pond is proposed. When the preg. pond is no longer needed and the draindown rate of the leach pad can be more precisely estimated, the sump would be eliminated and the draindown would be piped directly to a distribution box at the leachfield. Until that time, the sump pump will enable the discharge flow rate to be adjusted to meet system capacity.

Pump and Pipeline. The in-pond sump pump will be located in the southwest corner of the preg. pond where sediment build-up is minimal and electrical power is easily accessed. The sump pump will pump fluid from the preg. pond via a polyethylene pipeline to the distribution box for the leach field. The sump pump would be sized to pump the maximum estimated fluid flow and would have an adjustable pump rate. The schematic design for the sump and sump pump shown in Sketch 2 in Appendix C shows the key components: a submersible pump suspended approximately one foot above sump bottom; a polyethylene cylindrical sump with an over-sized bottom plate to enable weighting of the sump in the pond; perforations in the sump wall to allow water to enter; and a motor, discharge line, and controls (float switch and pressure relief valve). The sump pump would operate continuously except when low water level resulted in

automatic shut-off by the float valve: A pressure relief valve would divert fluid flow from the discharge line back into the preg. pond when excess pressure in the distribution box dictates. The unburied section of the discharge pipeline would be insulated or heat-traced to prevent freezing. The buried section of the pipeline would be placed below freeze depth for the entire length. The pipeline would be two-inch (minimum) HDPE.

Distribution Box. Currently a pre-manufactured septic tank, which would serve as an equalizing basin when the stem becomes gravity-fed, is the proposed flow-control distribution box. When the sump pump is providing fluid flow to the leachfield, bypass capability will allow fluid to be pumped directly to the leach field.

Leachfield. The leachfield would be constructed in tiers, owing to the slope of the ground surface at the proposed location. Each tier would be constructed so as to be level. Following the guidance in R317-4-9, leachfield piping would be four-inch PVC. Perforated laterals would not exceed 100'. The permeability of the site soils, based on the single percolation test, would cover an application area of 0.9 square feet per gallon per day. Accordingly, approximately 25,600 square feet of application area would be required in order to dispose of 20 gpm. Therefore, 12,800 linear feet of ditch, as shown on Sketch 1 of Appendix C would be required for the projected fluid disposal. If the average permeability at the proposed site were that found at the south perc. test location, this same system would infiltrate 10 gpm. Distribution ditches would be filled with washed gravel to a level of no less than 6 inches and distribution laterals would be covered with 2 inches of gravel.

Next Steps. In the interest of budget limitations, JBR has not yet attempted to optimize the system design. The system size would likely make the construction expensive. Before proceeding further with design, the input and experience of DWQ is sought. Meanwhile, JBR will conduct a longer-term perc. test at the west site immediately to assess whether more extended swell-time is necessary to better assess in-field perc. Rates.

APPENDIX A
Leach Pad Draindown Fluid Water Quality

Table A-1. Water Quality Summary - Leach Pad Draindown Fluid

North Lily Mining Company Silver City Facility

Date / Sampled by	??-99 DWQ	Apr-00 DWQ	Aug-00 JBR	Utah Ground Water Quality Standard
Parameter				
pH	9.1	8.7	8.1	6.5 - 8.5
Conductance (umhos/cm)	23,000	22,000	23,300	NS
TDS (mg/l)	19,510	18,358	20,000	NS
Alkalinity as Bicarbonate (mg/l)	364	248	388	NS
Total Hardness (mg/l)	1,409.8	1,296.4	NA	NS
Chloride (mg/l)	2,125	2,025	2,220	NS
Cyanide, Amenable to Cl_2 (mg/l)	20.865	34.87	18.80	NS
Cyanide, Total (mg/l)	20.9	35	19	NS
Cyanide, WAD (mg/l)	NA	NA	14.400	0.2 (free)
Fluoride	NA	NA	6.700	4.0
Nitrite, Nitrogen mg/l)	NA	NA	51.000	1.0
Nitrate + Nitrite Total (mg/l)	124	2,110	145	10.0
Sulfate (mg/l)	11,000	4,560	10,200	NS
Barium (mg/l)	0.015	ND	0.010	2.0
Calcium (mg/l)	539	481	350	NS
Chromium (mg/l)	0.009	ND	ND	0.1
Copper (mg/l)	5.70	0.332	19.000	1.3
Magnesium (mg/l)	15.8	0.234	29.000	NS
Manganese (mg/l)	0.130	0.110	NA	NS
Potassium (mg/l)	297	293	310	NS
Sodium (mg/l)	5,570	5,500	5,600	NS
Zinc (mg/l)	0.091	ND	0.420	5.0
Arsenic (mg/l)	0.900	0.076	0.246	0.05
Cadmium (mg/l)	ND	ND	0.008	0.005
Mercury (mg/l)	NA	0.089	ND	0.002
Lead (mg/l)	0.076	0.009	0.158	0.015
Selenium (mg/l)	0.200	0.014	0.271	0.05
Silver (mg/l)	0.370	0.029	0.315	0.10

NA = "Not Analyzed"

ND = "Not Detected"

NS = "No Standard"

1999 #1

FILE COPY

North Lilly flow into pond

Lab Number 199908572 Indicator I

PH	9.1	L-pH		199925717
TSS	<4	T.Sus.Sol	mg/l	199925802
NO2+	124	NO2+NO3, N	mg/l	199925903
CN	20.9	Cyanide	mg/l	199925815
D-AS	900	D-Arsenic	ug/l	199928634
D-BA	15	D-Barium	ug/l	199928637
D-CD	<1	D-Cadmium	ug/l	199928636
D-CA	539	D-Calcium	mg/l	199928604
D-CR	9	D-Chromium	ug/l	199928630
D-CU	5700	D-Copper	ug/l	199928632
D-FE	<220	D-Iron	ug/l	199928701
D-PB	76	D-Lead	ug/l	199928638
D-MG	15.8	D-Magnesum	mg/l	199928602
D-MN	130	D-Mangan	ug/l	199928631
D-K	297	D-Potassum	mg/l	199928603
D-SE	200	D-Selenium	ug/l	199928635
D-AG	370	D-Silver	ug/l	199928639
D-NA	5570	D-Sodium	mg/l	199928601
D-AG	370	D-Silver	ug/l	199928639
D-NA	5570	D-Sodium	mg/l	199928601
D-ZN	91	D-Zinc	ug/l	199928633
BICB	364	Bicarbnate	mg/l	199925717
CO2	0.0000000	Carb. Diox	mg/l	199925717
CARB	0.0000000	Carbonate	mg/l	199925717
CL	2125	Chloride	mg/l	199927211
OH	0.0000000	Hydroxide	mg/l	199925717
SO4	11000	Sulfate	mg/l	199925803
ALK	298	Tot. Alk.	mg/l	199925717
HARD	1409.8	T. Hardns.	mg/l	199925717
TURB	0.54	Turbidity	NTU	199925616
COND	23000	L-Sp. Cond	umhos	199926021
TDS	19510	TDS @ 180C	mg/l	199925816
D-AL	<30	D-Aluminum	ug/l	199928629
CNCL	20.865	Cyan. (Cl)	mg/l	9925815
D-HG	333	D-Mercury	ug/l	199929803
CO3	179	CO3 Solids	mg/l	199925717

2000

UTAH STATE DEPARTMENT OF HEALTH
DIVISION OF LABORATORY SERVICES
Environmental Chemistry Analysis Report

UDEQ - DWQ
ARNE HULTQUIST
288 N 1460 W
PO BOX 144870
SALT LAKE CITY UT 84114-4870 801-538-6146

Lab Number: . 200002437 Sample Type: 04 Cost Code: 352
Description: NORTH LILY FLOW FROM HEAP LEACH INTO POND

Site ID: 599712 Source No: 02
Sample Date: 04/04/00 Time: 10:00

Tot. Cations: 6297 mg/l 272.7 me/l
Tot. Anions: 6797 mg/l 157.9 me/l
Grand Total: 13094 mg/l %D = 26.7

Organic Review:
Inorganic Review: 07/10/00
Radiochemistry Review:
Microbiology Review:

TEST RESULTS:

L-pH	8.68	T.Sus.Sol	9.0 mg/l
NO2+NO3, N	2110.0 mg/l	Cyanide	35.0 mg/l
D-Arsenic	76.0 ug/l	D-Barium	<5.0 ug/l
D-Cadmium	<1.0 ug/l	D-Calcium	481 mg/l
D-Chromium	<5.0 ug/l	D-Copper	332.0 ug/l
D-Iron	<20.0 ug/l	D-Lead	9.0 ug/l
D-Magnesum	23.4 mg/l	D-Mangan	11.0 ug/l
D-Potassum	293 mg/l	D-Selenium	14.0 ug/l
D-Silver	29.0 ug/l	D-Sodium	5500.0 mg/l
D-Zinc	<30.0 ug/l	Bicarbnate	248 mg/l
Carb. Diox	1 mg/l	Carbonate	0 mg/l
Chloride	2025 mg/l	Hydroxide	0 mg/l
Sulfate	4650.0 mg/l	Tot. Alk.	203 mg/l
T. Hardns.	1296.4 mg/l	Turbidity	0.235 NTU
L-Sp. Cond	22000 umhos	TDS @ 180C	18358 mg/l
D-Aluminum	<30.0 ug/l	Cyan. (Cl)	34.87 mg/l
D-Mercury	89.1 ug/l	CO3 Solids	122 mg/l

QUALIFYING COMMENTS (*) on test results: NO COMMENTS

END OF REPORT

CHEMTECH-FORD ANALYTICAL LABORATO

Date: 9/22/00

To: JBR Consultants
attn. Scott Page
8160 South Highland Drive, Ste. A-4
Sandy, UT 84088

Group #: 39788
Lab #: 00-U007946
Project: SILVER PEAK
Sample Desc: Heap Leach Outfall
Sample Matrix: WASTE WATER
Date/Time Sampled: 8/22/00 , 14:00
Date/Time Received: 8/23/00 , 10:15

CERTIFICATE OF ANALYSIS

PARAMETER	RESULT	MINIMUM REPORTING LIMIT (MRL)	DATE ANALYZED	METHOD	ANALYST
INORGANIC PARAMETERS					
Alkalinity,as Bicarbonate, mg/L	388	1	8/25/00 12:00	SM 2320B	TSM
Alkalinity, as Carbonate, mg/L	< 1	1	8/25/00 12:00	SM 2320B	TSM
Chloride, mg/L	2,220	10	8/30/00 14:00	EPA 325.3	TSM
Conductance, Specific, umhos/cm	23,300	1	8/31/00 10:15	EPA 120.1	MJB
Cyanide, Amenable to Cl2, mg/L	18.8	0.002	9/ 1/00 13:00	ASTM D2036	PNM
Cyanide, Total, mg/L	19	1	9/ 1/00 13:00	ASTM D2036	PNM
Cyanide, WAD, mg/L	14.4	0.457	9/ 8/00 8:00	ASTM D2036	PNM
Fluoride, mg/L	6.7	0.2	9/ 7/00 10:00	EPA 340.2	TSM
Mercury, as Hg (D), mg/L	< 0.0002	0.0002	8/28/00 12:40	EPA 245.2	MJB
Nitrite, Nitrogen, mg/L	51	1.25	8/23/00 12:45	EPA 354.1	TSM
Nitrate+Nitrite-Total, mg/L	145	10	8/31/00 15:00	EPA 353.1	EJB
pH, units	8.1	0.1	8/23/00 12:30	EPA 150.1	LPS
Sulfate, mg/L	10,200	2000	8/29/00 16:00	EPA 375.4	TSM
Total Dissolved Solids, mg/L	20,000	25	8/24/00 12:30	EPA 160.1	LPS
Barium (D), as Ba, mg/L	0.010	0.005	8/29/00 15:19	EPA 200.7	JJT

Approved By: David Gayer
David Gayer, Laboratory Director

MRL = Report detection limit

(generic.rpt)

6100 SOUTH STRATLER
SALT LAKE CITY UTAH 84107 6905
801 262 7299 PHONE
801 262 7378 FAX

Date: 9/22/00

To: JBR Consultants
attn. Scott Page
8160 South Highland Drive, Ste. A-4
Sandy, UT 84088

Group #: 39788
Lab #: 00-U007946
Project: SILVER PEAK
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Sample Matrix: WASTE WATER
Date/Time Sampled: 8/22/00 , 14:00
Date/Time Received: 8/23/00 , 10:15

CERTIFICATE OF ANALYSIS

PARAMETER	RESULT	MINIMUM REPORTING LIMIT (MRL)	DATE ANALYZED	METHOD	ANALYST
INORGANIC PARAMETERS					
Calcium (T), as Ca, mg/L	350	0.2	8/29/00 15:19	EPA 200.7	JJT
Chromium (D), as Cr, mg/L	< 0.005	0.005	8/29/00 15:19	EPA 200.7	JJT
Copper (D), as Cu, mg/L	19	0.01	8/29/00 15:19	EPA 200.7	JJT
Magnesium (T), as Mg, mg/L	29	0.2	8/29/00 15:19	EPA 200.7	JJT
Potassium (T), as K, mg/L	310	0.2	8/29/00 15:19	EPA 200.7	JJT
Sodium (T), as Na, mg/L	5,600	20	9/ 5/00 16:25	EPA 200.7	JJT
Zinc (D), as Zn, mg/L	0.42	0.01	8/29/00 15:19	EPA 200.7	JJT
Arsenic (D), as As, mg/L	0.2464	0.0005	9/ 6/00 14:16	EPA 200.8	JJT
Cadmium (D), as Cd, mg/L	0.0076	0.0005	9/ 6/00 14:16	EPA 200.8	JJT
Lead (D), as Pb, mg/L	0.1581	0.0005	9/ 6/00 14:16	EPA 200.8	JJT
Selenium (D), as Se, mg/L	0.2707	0.0005	9/ 6/00 14:16	EPA 200.8	JJT
Silver (D), as Ag, mg/L	0.3147	0.0005	9/ 6/00 14:16	200.2/200.8	JJT
Temperature, Receiving, C	18.0		8/23/00 10:15		CSM

Approved By: David Gayer
David Gayer, Laboratory Director

MRL = Report detection limit

(generic.rpt)

6100 SOUTH STRATLER
SALT LAKE CITY UTAH 84107 6905
801 262 7299 PHONE
801 262 7378 FAX

TRANSMITTAL

STATE OF UTAH

DIVISION OF WATER QUALITY
DEPARTMENT OF ENVIRONMENTAL QUALITY
P.O. BOX 144870
288 NORTH 1460 WEST
SALT LAKE CITY, UTAH 84114-4870
Main Phone # (801) 538-6146 Fax # (801) 538-6016

☐ MAIL
☑ FAX NUMBER 942-1852

TO: Bob Bayer

PHONE # _____

DATE: 9/28/2000

FROM: Beth Wondimu

PHONE# 538-6084

We are pleased to provide the following to you:

No. of pages including cover sheet: 2

ITEM: _____

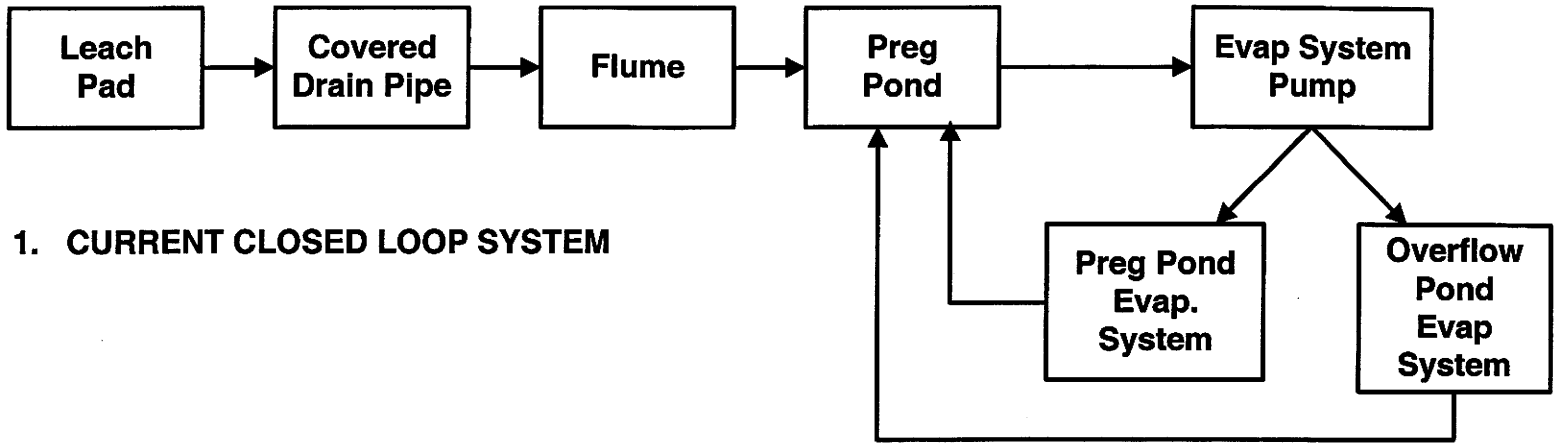
- ☐ For your action
- ☐ For your information
- ☐ Per previous conversation on _____
- ☐ Per your/our correspondence dated _____
- ☐ Other _____

MESSAGE: These are samples taken in 1999 & 2000 by DWQ.

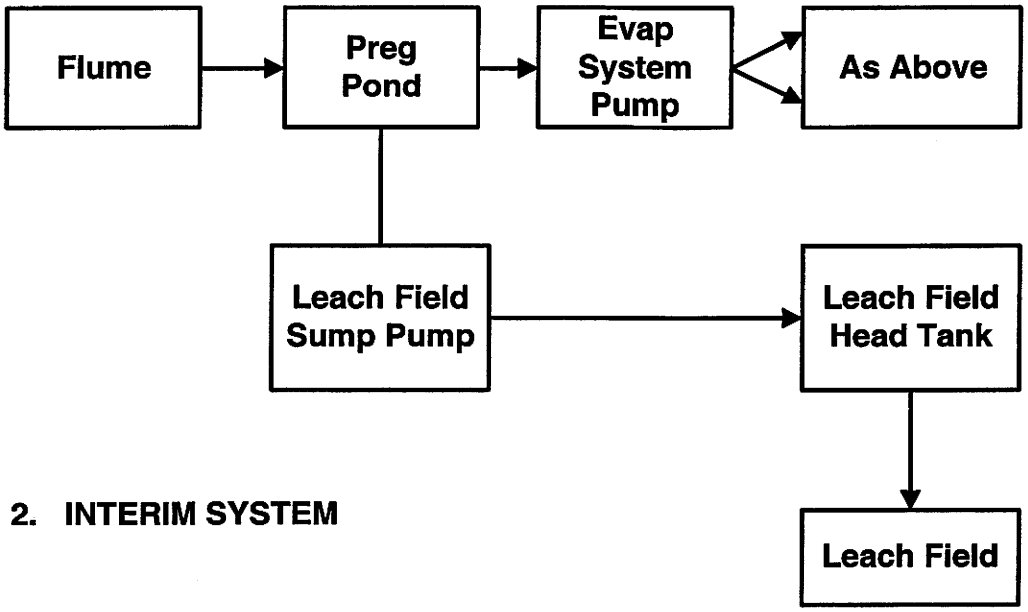
K:\MF\UGATE\WP\TRANSMIT.MM

POST CLOSURE FLUID MANAGEMENT SYSTEM

FLOW SHEET



1. CURRENT CLOSED LOOP SYSTEM



2. INTERIM SYSTEM

SECTION 25 | 36
26 | 35

SILVER CITY ROAD

HEAP LEACH PAD

Sump

PREG POND

BARREN POND

OVERFLOW POND

TOP SOIL STORAGE

DISTRIBUTION BOX

Buried 4" line

PERC. TEST PIT

U.S. HIGHWAY 6 & 50

SOUTH LAND APPLICATION SITE

SAMPLE LOCATION

S3 S4

S1 S2

WEST LAND APPLICATION SITE

SAMPLE LOCATION

W1 W2 W3 W4

N

SKETCH 1

POST CLOSURE FLUID MANAGEMENT SYSTEM

LAND APPLICATION SITE MAP
NORTH LILY MINING COMPANY
SCALE: (APPROXIMATE) 1" = 200'
DATE: MARCH 1997
BY: PAUL SPOR
FIGURE 1

jbr environmental consultants, inc.
Salt Lake City, Utah • Cedar City, Utah • Springville, Utah • Reno, Nevada • Elko, Nevada

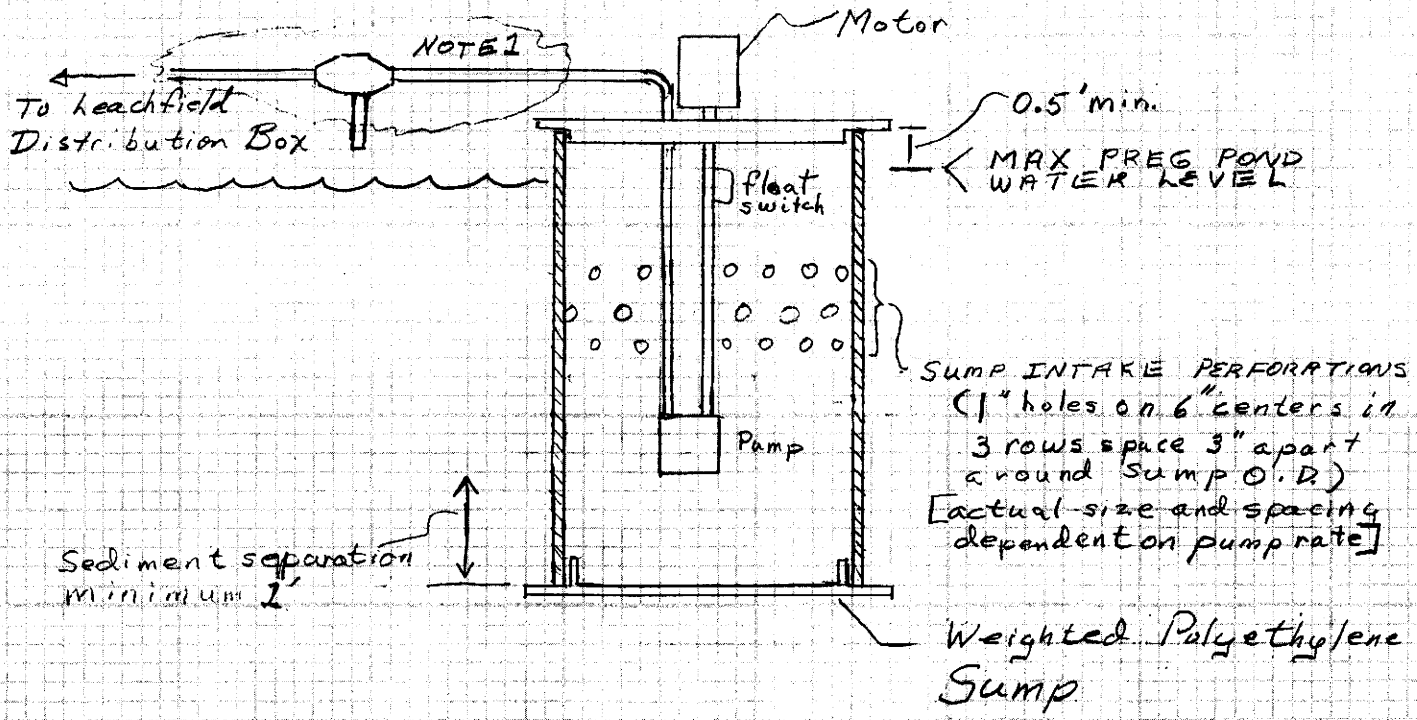
PROJECT NO. Nily-01
BY RJB DATE 9-25-00
CHK'D BY ____ DATE ____
SHEET NO. ____ OF ____

SKETCH 2

POST CLOSURE FLUID MANAGEMENT SYSTEM

LERCH FIELD SUMP PUMP

LOCATION: NORTHWEST CORNER OF PREG. POND



NOTE 1: Sump pump discharge line to be insulated or heat-traced from sump to point of burial.